



## VA demonstrates upper surface blowing concept

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WRIGHT-PATTERSON AIR FORCE BASE, Ohio — Scientists at the Air Force Research Laboratory's Air Vehicles Directorate worked with Compositex, Inc. to prove the Upper Surface Blowing (USB) concept as one possible method for achieving powered lift. The effort was coordinated under the Small Business Innovation Research program.

This technology may one day increase the range of speeds at which large air vehicles, like tanker or transport aircraft, can fly. While not interfering with maximum speed, powered lift could enable these air vehicles to fly at speeds just above a hover. In addition, it may decrease the ground footprint required for taking off and landing.

Engineers successfully demonstrated USB during the flight test of a small unmanned air vehicle (UAV) that weighed approximately six pounds. Not only did the success of this demonstration prove the possibility of using USB technology, it also opened up possibilities for using the same type of small UAV to demonstrate future air vehicle concepts.

In this version of USB, airflow generated by a ducted fan is channeled into a plenum inside the wing instead of exhausting through a conventional nozzle. The flow then exits the plenum through a narrow, aft-facing blowing slot that runs along the wing span on the upper side of the wing just aft of the leading edge. The resulting jet entrains air over the wing's upper surface, similar to the "ejector" concept. It also acts like a "jet flap", thus increasing both thrust and lift. This increase should enable very low-speed flight as well as short take-off and landing operations.

Engineers have been examining powered lift since the 1950's; however, they have had little success putting the theory into practice. One obstacle to successful implementation has been weight and efficiency penalties due to the plumbing. Another obstacle is that often, good low-speed performance comes at a severe cruise drag penalty. The current effort aims at risk reduction by demonstrating the concept in a small UAV, where design changes can be made cheaply and rapidly.

The next step is to optimize the concept. Engineers will use wind tunnel testing in addition to data collected during this demonstration to suggest design improvements. Evaluations of these improvements will determine if USB is a viable method to achieve powered lift. @